

ZOOLOGY.—Notes on *Paratylenchus*, a genus of nemas. N. A. COBB. U. S. Department of Agriculture.

The following paragraphs contain new information with regard to the lip region, vestibule, spear guide, structure of the spear, median bulb, salivary glands, deirids (cervical papillae), renette, eggs and their deposition, and gonism of *Paratylenchus* Micoletzky 1922.

Paratylenchus nanus n. sp. $\frac{8.2}{3.7}$ $\frac{18}{4.3}$ $\frac{24}{4.5}$ $\frac{32}{4.2}$ $\frac{82}{2}$ $\frac{95.8}{2}$ $\frac{0.41}{0.41}$ The transparent, colorless, naked cuticle, about 1.5 microns thick, is traversed by plain, transverse striae, 2.0 microns apart except near the extremities, all alike and fairly easy of resolution, which are materially altered on the lateral fields by the presence of wing regions, about one-seventh as wide as the body, beginning on the neck and ending on the tail. The optical expression of the wings on living specimens usually consists in four parallel longitudinal lines on each lateral field, the two outer of which are fainter than the two inner. Very slightly oblique longitudinal striae of the subcuticle, all alike, due to the attachment of the musculature, are rather easily to be seen in nearly all regions of the body. The contour of the body is crenate or very faintly serrate-crenate. There are no dermal appendages and there are no series of pores to be seen in the cuticle. On the neck opposite the excretory pore, lat. 22.2,* there is a papilla on each lateral line, and, leading inward, ventrad and slightly backward from the middle of each papilla is an obscurely sinuous element connecting with the nervous system. These two organs are therefore believed to be deirids ("cervical papillae").

The neck, which is cylindroid posteriorly, and to a considerable extent also anteriorly, becomes decidedly convex-conoid farther forward, and ends in a rounded or subtruncate, continuous head compassing about thirty annules of the cuticle, which presents a somewhat depressed, very minute, central mouth opening, closely surrounded by six equal, exceedingly minute lips. The truncation of the head occurs at the lip region, which has at this point, that is at the anterior extremity of the nema, a width of about two microns. The lip region is supported by a faintly visible six-ribbed, refractive, somewhat dome-shaped, cuticular framework, six to seven microns across at the base, and about two-thirds as "high" as it is wide. The more or less immobile lips are usually closed.

*The Word "Latitude" in Descriptive Nematology. I have lately come to use the word "latitude" in a conventional sense in dealing with nema anatomy, and find it so useful as to lead to this attempt more accurately to define the word as thus used.

The meaning of latitude in this connection arises from geographical usage, but in nematology the term applies to a transverse plane or section of the organism, and not to a circle on the surface only, as in geography, and it has not seemed desirable to have two sorts of latitude, such as north and south.

One hundred degrees of latitude is assumed, with zero at the anterior extremity of the organism. Thus an element of the organism in latitude 50 would be at the middle; and in latitude 100 at the end of the tail. The terms can be abbreviated as in geography so as to be short and specific. Thus: lat. 60.

In the case of nemas, which are so nearly round in cross section, a similar use of the word "longitude" sometimes becomes useful, the ventral line being taken as the zero line, the dorsal line thus becoming 180.

The conventional use of the words latitude and longitude in this way is more or less "logical", and very easily acquired, and, according to my experience, is a decided saving in time and space, and has the merit of definiteness, as well as brevity.

There is a small *combined vestibule and spear guide*, about as wide as the lip region and some ten microns long, more or less visible on account of the refractive nature of its elements. This portion of the labial structure has for one of its main functions the guidance of the spear when in action. The vestibular part is about four microns deep and varies somewhat in diameter according to the attitude of the lips and spear. Leading backward from the base of the vestibule there is a symmetrical set of outwardly bowed, somewhat flexible, rather slender, longitudinal elements constituting the main portion of the spear guide. The relatively very robust spear is about twice as long as the base of the head is wide. It ends posteriorly in a distinctly three-lobed expansion toward one-third as wide as the base of the head, the dorsal lobe being slightly farthest back, and sometimes at least presenting a dorso-posterior condyle. It is somewhat behind, and in a line with, the axil of the dorsal lobe that the *dorsal salivary gland empties into the oesophageal lumen*. The spear often tapers more or less regularly throughout its length; nevertheless there is a distinct basal part, comprising about two-fifths of the whole, set off by a minute but distinct junction mark, and averaging about one-sixth as wide as the corresponding portion of the head. At its distal end the spear is exceedingly finely pointed. Well developed muscles for the protrusion of the spear are readily seen and often lie rather close to the spear,—not forming any very marked swelling when at rest. Anteriorly there are *six of these muscles*,—one passing to each sector of the labial framework.

No amphids have been seen. There are no eyespots.

The oesophagus is tylenchoid and presents a very definite, somewhat *pine-apple-shaped, non-muscular valveless cardiac swelling*, half as wide as the base of the neck. The very long, large, rather ob-clavate, median swelling, which is two-thirds as wide as the middle of the neck, is set off abruptly behind, but is decurrent in front and reaches to, and somewhat includes, the base of the onchium; in its posterior part it presents a *well-developed, elongated-fusiform, triplex valve*, occupying one-third of the diameter, to which are attached the usual radial muscles for the opening of the valve in the act of swallowing. An interesting peculiarity of the median swelling is that the contained robust tubular oesophageal lining, which is *disposed in a single loop or coil when at rest, takes on this attitude without much disturbance to the evenness of the contour of the swelling itself*, thus showing the "clavate swelling" to be a distinctly two-fold affair,—partly (posteriorly) muscular, and partly (dorsally throughout) glandular, and with the two tissues so little connected that the glandular part is comparatively separate and responds but little to the movements of the tubular lining. Ordinarily one would expect the anterior narrower part of such a long median swelling to curve or coil along with the lining. Though the limits of the true median bulb (not the clavate swelling but the included median bulb more properly speaking), are often somewhat indefinite anteriorly, it may properly be described as ellipsoidal, two-thirds as wide as the neck and two and one-half times as long as wide; in other words the *entity of the median muscular bulb is not entirely lost*. Behind the pharynx the oesophagus is one-sixth, at the nerve ring only about one-tenth, in front of the cardiac swelling about one-eighth, and finally one-half, as wide as the corresponding portion of the neck. The lining of the oesophagus is tubular and narrow, and distinct except in the posterior glandular bulb,—most distinct in the clavate swelling.

There are *well developed salivary glands*. The nucleus of one of these organs may be seen in the dorsal sector of the cardiac swelling, as already described,—dorsad and occupying the major part of it,—and emptying into the oesophageal lumen near the onchium. It is doubtful if salivary secretion passes also into the base of the fusiform median valve, though there seem to be two subordinate nuclei in the cardiac swelling.

There are two or three somewhat ellipsoidal organs, half as wide as the body, about two-thirds as wide as long, located just behind the base of the neck, and closely associated with the beginning of the intestine. These regularly darken in Flemming's solution and are as yet of unknown significance. There is no cardia. The thick walled intestine, which is set off from the oesophagus by a rather faint cardiaec collum one-half as wide as the base of the neck, presents a faint, though fairly capacious lumen. It is composed of cells of such a size that probably only about two are presented in each cross section. It becomes at once two-thirds as wide as the body. From the very inconspicuous, continuous anus, the rectum, which is also very inconspicuous, extends inward and forward. There is no distinct pre-rectum. The numerous, colorless granules found in the cells of the intestine, the largest of which are about one-tenth as wide as the body, namely about two microns in diameter, are not so arranged as to give rise to a tessellated effect. Sometimes the cells throughout the intestine are uniformly filled with granules; more often the granules are absent here and there, so as to create a "segmented" effect.

The tail, which compasses about twenty annules of the cuticle, is conoid, subarcuate, and tapers from in front of the anus to the rather blunt, or sometimes subacute, unarmed, symmetrical terminus. There is no spinneret. There are no caudal glands and there are no caudal setae.

Apparently the lateral chords are about one-third as wide as the body. The rather prominent excretory pore is located just behind the nerve ring and the excretory duct can be followed inward and backward along the right lateral chord at least as far as the middle of the body.

The nerve ring is oblique, of medium size and accompanied, fore and aft, by numerous nerve cells, some of which lie as far forward as opposite the middle of the median oesophageal swelling.

The single female sexual organ is outstretched forward. From the unusually large, depressed and very conspicuous vulva, the vagina, which is large, extends inward obliquely forward, three-fourths the distance across the body. Its walls are rather strongly cutinized. The larger anterior lip of the vulva may be slightly elevated. The body of the nema decreases a little in diameter rather suddenly at the vulva and tapers more rapidly thence backward. The thin-shelled, smooth, elongated egg is nearly thrice as long as the body is wide and measures about 60 x 20 microns. Only one egg occurs in the uterus at a time. A prolate compact mass of sperm cells, often comprising some two to five hundred minute, spherical, refractive elements, occurs regularly in the uterus of newly adult females: this sperm mass is often two-thirds to three-fourths as wide as the body. From the formation and size of the sperm cells it is concluded that the species is syngonic. No males have been seen among about fifty females, many gravid, from two North American regions. The medium sized ovary is usually cylindroid posteriorly, and tapers anteriorly; it averages to be about one-third as wide as the body. Toward fifty ova, arranged for the most part single file, are to be seen in the ovary. There is practically no post-vulvar rudiment of a sexual organ.

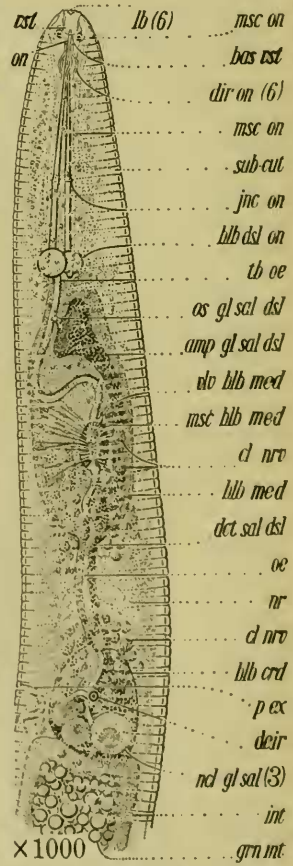


Fig. 1. Anterior part of a female *Paratylenchus nanus*.

Habitat: Found in soil about the roots of grasses, Devil's Lake, North Dakota, April, 1915; and Four Mile Run, Falls Church, Va., August, 1922. Flemming's solution to glycerine jelly. In many respects this species closely resembles *Tylenchus macrophallus* de Man, but differs in the following particulars;—the spear is somewhat longer and possibly somewhat more robust; the striation is coarser; the body is wider; the tail of *nanus* compasses twenty annules while that of *macrophallus* appears to compass about fifty; opposite the spear in *nanus* there are about twenty-five to thirty annules, while in *macrophallus* there appear to be about forty. Should opportunity occur it would perhaps be advisable to re-examine the median oesophageal region of *macrophallus*. For the present at least it seems best, unless the undiscovered male of *nanus* should prove to be extraordinarily like the male of *macrophallus*, to regard the two species as distinct. *Paratylenchus* is related to the very well-defined genus *Iota*, a genus whose numerous representatives typically are minute, very short, very broad, coarsely annuled, rather inflexible nemas found in acid soils, and having the single outstretched female sexual organ emptying through a vulva located very close to the minute, inconspicuous anus and often possessing external coarse retrorse cuticular elements,—ridges, scales, spines, fringes, etc., according to the species. There is a number of as yet unpublished species of which it is not easy to make a satisfactory assignment as between *Iota* and *Paratylenchus*. The unknown males of *nanus*, if such exist, may be expected to throw more light on the generic relationships. *P. nanus* may be synonymous with *P. bukowinensis* Micoletzky, 1922.

$\frac{10.}{4.8} \frac{26.}{5.1} \frac{31.}{5.6} \frac{53}{5.1} \frac{83.}{5.1} \frac{93.}{3.1} - 0.96mm$ are the measurements of a living specimen of *P. nanus* under slight pressure and therefore a little flattened, and furthermore showing a neck-length unaltered by fixation and preservation.

Paratylenchus anceps n. sp. $\frac{24.}{5.3} \frac{28.}{5.3} \frac{34.}{5.3} \frac{Y}{4.6} - \frac{92.6(\eta)}{3.6} 0.28mm$ *P. anceps* so closely resembles *P. nanus* that only the differences need be here noted. The striae are one micron apart. The optical expression of the wings is a pair of refractive parallel lines whose distance apart is about equal to the width of two annules of the cuticle. The conoid neck becomes convex-conoid at the head, at the front of which the lip region is about four microns wide. The spear guide is six microns long, and the spear about half as long as the neck, the long slender anterior part comprising three-fourths or four-fifths of the whole. The three-lobed, flattish basal bulb of the spear is about one-fourth as wide as the corresponding portion of the neck, that is about four microns wide. The somewhat elongated-pyriform or pineapple-shaped posterior bulb is three-fifths as wide as the base of the neck. The deirids are near the base of the neck. The tail is slightly conoid to the broad, rounded terminus, which is half as wide as the base of the tail. The vulva was about to appear at the same relative position as in *P. nanus*. In all other respects almost precisely as in *P. nanus*.

Habitat: Roots of *Umbellularia californica*, Riverside, California, 1912.